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AF/3752

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

#23 Appeal Brief 11/20/03

In re Application of: M. Barrera et al.	
Serial No: 09/675,860	GROUP ART UNIT: 3752
Filed: September 29, 2000	EXAMINER: Christopher S. Kim
For: APPARATUS AND METHOD OF EFFECTIVE FLUID INJECTION AND VAPORIZATION FOR CHEMICAL VAPOR DEPOSITION APPLICATION	DATE: November 12, 2003

Mail Stop Appeal Brief – Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

BRIEF FOR APPELLANTS

This is an appeal from the Final Rejection of the Examiner mailed June 25, 2003 finally rejecting claims 1-5, 7-10, 12-17, 19-21 and 26-30. A Notice Of Appeal and the appeal fee were timely mailed and received in the United States Patent and Trademark Office on September 23, 2003. An appeal fee in the amount of $330 is enclosed. Please charge any over or under payment to Deposit Account No. 04-0566. Three copies of the brief are enclosed.

REAL PARTY IN INTEREST

The real party in interest is the assignee of all rights in this application, Novellus Systems, Inc., a corporation of the State of California, having a place of business at 3970 North First Street, San Jose, California 95134.

RELATED APPEALS AND INTERFERENCES

There are no appeals or interferences known to Appellants, Appellants' legal representatives, or assignee, which will directly affect, or be affected by, or have a bearing on the Board's decision on this appeal.

STATUS OF CLAIMS

The subject application was filed on September 29, 2000 with claims 1-23. In response to the Office Action mailed February 1, 2002, a Request for Restriction Requirement was mailed March 1, 2002, electing with traverse, the claims of Group I, claims 1-21, drawn to an apparatus.

An Office Action was mailed April 18, 2002, and a response thereto was filed June 5, 2002 wherein non-elected claims 22 and 23 were canceled, and claims 1-14 and 16-21 were amended. Figure 2 was also amended and Fig. 6 added. A final rejection Office Action was mailed August 12, 2002 rejecting the pending claims, to wit, claims 1-21. An Amendment After Final Rejection was submitted on October 22, 2002 amending the claims and adding new claims 24-27. An Advisory Action dated October 31, 2002 was received wherein it was advised that the Amendment filed October 22, 2002 would not be entered.

A Request for Continued Examination was filed November 7, 2002, along with a Replacement Amendment After Final Rejection in which amendments were made to claims 1, 2, 4-10, 12-14 and 16-21. A non-final Office Action was mailed January 1, 2003, still rejecting all the claims in the application, to wit, claims 1-21 and 24-27. In response, an Amendment was filed May 6, 2003 canceling claims 6, 11, 18, 24 and

25; amending claims 1, 2, 4, 5, 7, 8, 10, 13, 16, 17, 19, 21, 26, and 2; and adding claims 28-30. Fig. 2 was also amended.

A Final Rejection Office Action was mailed June 25, 2003 maintaining the rejection of the claims, to which a Response was filed August 7, 2003 in which no amendments were made. In view of the Advisory Action issued on August 13, 2003, it is Appellants' belief that the Response filed August 7, 2003 is of record. A Notice of Appeal was filed September 23, 2003.

STATUS OF AMENDMENTS

All the amendments added during prosecution of the application have been entered and are presently in the application. The rejected claims 1-5, 7-10, 12-17, 19-21 and 26-30, as they presently stand, are set forth in the Appendix. A summary of the rejection of the claims may be found in the Office Action mailed June 25, 2003.

SUMMARY OF THE INVENTION

In chemical vapor deposition (CVD), reactants and other dopants are injected in vapor phase over substrates for deposition thereon. However, several problems are created by the physical properties that such materials undergo within the CVD chamber. (Specification, page 1, lines 9-15.)

Referring to Fig. 1, prior art has focused on pre-mixing solutions within a heated injector manifold 30 and transporting such pre-mixed fluids to a mixing chamber 35. (Specification, page 7, lines 3-18.) Once mixed, the mixture enters showerhead 26 through a ceramic tube 25, and then the solution vaporizes over a substrate for efficient mixing and deposition thereon. (Specification, page 7, lines 18-21; and page 3, lines 2-6.) However, certain precursors and dopants are not fully vaporized by such

methods, such as tetraethylorthosilicate (TEOS), which does not fully atomize upon entering the gas manifold. This incomplete atomized of liquids entering into the gas manifold leads to inefficient deposition on the process wafers with the potential risk of carrier gas material landing on the wafer. (Specification, page 2, line 28 to page 3, line 25.)

The present invention is aimed at overcoming the above problems of pre-mixing, and then mixing, followed by the transportation of such mixed solutions to a chamber for injection therein. In so doing, the invention presents an apparatus that avoids the stage of pre-mixing of solutions prior to introduction into mixing chamber 35 for the completion of mixing therein.

In particular, the present invention avoids pre-mixing of solutions by providing a chemical vapor deposition chamber having a cavity, particularly a cross-flow injector, which includes an inlet nozzle, a throat region and an exit nozzle. (Specification, page 8, line 13 to page 9, line 8.)

In more detail, this cavity (cross-flow injector) includes an inlet nozzle 50 for a carrier fluid, such as O_2, N_2, or He, having a diameter D_1, and configured to maintain a first pressure, P_1, and first temperature T_1. (Specification, page 8, lines 15-19.) The inlet nozzle 50 tapers to a narrower throat region 44, operating at mach 1.0, that has a second diameter D_2 (smaller than D_1), where the fluid undergoes a second pressure, P_2 (lower than P_1 and higher than a third pressure P_3 at exit nozzle 42), and temperature, T_2. (Specification, page 8, lines 19-25.) Inlet ports 46 and 48 are connected to throat region 44 for injecting liquids 1 and 2 therein, whereby at the point of introduction into throat 44 are atomized by the fluid flow of the carrier fluid through the inlet nozzle 50 such that mixing occurs in the throat and at the exit nozzle 42. (Specification, page 8, line 25 to page 9, line 4.)

Further, several injection points may be introduced into the throat region 44 (such as inlets 46 and 48 for liquids 1 and 2) so that more than one liquid may be injected simultaneously, thus allowing for the doping of films while not requiring a pre-mixing of these liquids. (Specification, page 9, lines 5-8.) That is, no pre-mixing of liquids 1 and 2 occurs prior to their introduction into throat region 44 in the present apparatus.

As shown in Figs. 2 and 3A, the exit nozzle 42 may have a diameter D_3 that is greater than the diameter D_2 of the throat region 44 (specification, page 9, lines 11-17), or alternatively as shown in fig. 6, have substantially the same diameter as that of the throat 44, D_2, (specification, page 10, lines 27-29). Regardless, an important feature of the invention is that more than one fluid may be introduced simultaneously through the cross-flow injector without pre-mixing the fluids. This provides for the fluid to be introduced into the low pressure process chamber and become efficiently atomized without concern of cavitation in the fluid supply lines. (Specification, page 14, lines 14-21.)

ISSUES

I. Claims 1, 3-5, 7-10, 13, 15-17, 19-21, and 26-30 have been rejected under 35 USC 102(b) as being anticipated by Gwyn (U.S. Patent No. 4,397,422).

II. Claims 2, 12 and 14 have been rejected under 35 USC 103(a) as being unpatentable over Gwyn (U.S. Patent No. 4,397,422).

GROUPING OF CLAIMS

Claims 1, 3-5, 7-10, 26 and 29 stand or fall together.

Claims 13, 15-17, 19-21, 27 and 30 stand or fall together.

Claims 2, 12 and 14 stand or fall together.

Claim 28 stands alone.

ARGUMENT

I. The Drawings

Again, in view of the Advisory Action issued August 13, 2003, it is Appellants' belief that the Response filed August 7, 2003 is of record for purposes of the foregoing appeal. As such, it is Appellants' understanding that there are no current issues pending with respect to the drawings.

II. Prior Art

Gwyn (U.S. Patent No. 4,397,422) is directed to a colorant mixing and spraying device (10) that includes a pressurized air source (12) to supply relatively constant pressure air to a venturi mixer system (18) whereby colorants are drawn into the venturi throat for thorough mixing and subsequent introduction to a spray nozzle. (Fig. 1, and col. 1, lines 21-35 and col. 2, lines 20-22.)

The venturi mixer (18) has an inlet chamber (17), a throat region (19) and an outlet chamber (21). Three tubes (20) leading from separate containers (22) of colorant are connected to the throat region (19), whereby colorant is suctioned into the throat region from the different containers (22) by the flow rate of air flowing from the inlet chamber (17) into the throat region (19). The colorants are mixed together in the venturi throat (19). The mixed colorant then flows from the outlet chamber (21) through a hose (26) to a spray gun (28) at a pressure high enough to vaporize the paint. (Fig. 1 and col. 2, lines 18-49.)

III. The Examiner's Rejections and Appellants' Arguments

A. Claims 1, 3-5, 7-10, 13, 15-17, 19-21, and 26-30

The Examiner has rejected claims 1, 3-5, 7-10, 13, 15-17, 19-21, and 26-30 under 35 USC 102(b) as being anticipated by Gwyn (U.S. Patent No. 4,397,422).

Claims 1, 3-5, 7-10, 26 and 29

As recited, claims 1, 3-5, 7-10, 26 and 29 are directed to an apparatus for delivering a plurality of chemical vapor deposition fluids to a chamber. The apparatus includes a chemical vapor deposition chamber having a cavity that includes an inlet nozzle, a throat region and an exit nozzle.

In more detail, the inlet nozzle has a first diameter, pressure and temperature, and is adapted to receive a carrier fluid. The throat region has a second diameter and pressure, both less than the first diameter and pressure, and is connected to the inlet nozzle at a first end. The throat region also has a first and a second aperture for injecting first and second chemical vapor deposition dopants into the throat region for atomization and mixing therein by the carrier fluid.

The exit nozzle is connected to the throat region at a second end, and has an exit pressure lower than the second pressure and a third temperature. The exit nozzle has a third diameter greater than the second diameter and is configured to introduce the mixed atomized first and second chemical vapor deposition dopants and carrier fluid into the chemical vapor deposition chamber.

Appellants submit that the present invention is not anticipated by Gwyn, as all material elements of the claimed invention are not and cannot be found in the Gwyn patent. Anticipation is but the ultimate or epitome of obviousness. To constitute

anticipation, all material elements of a claim must be found in one prior art source. *In re Marshall*, 577 F.2d 301, 198 USPQ 344 (CCPA 1978).

Gwyn represents non-analogous art in that it teaches a paint-spraying device for mixing and spraying different colorants utilizing a venturi mixer system for the application of camouflage paints. It is not directed to, nor does even suggest, apparatus relating to chemical vapor deposition systems. Importantly, a venturi design has never been used for chemical vapor deposition processing, nor made or adapted to receive a chemical vapor deposition carrier fluid, mix the carrier fluid with a different chemical vapor deposition fluid in the throat region, atomize chemical vapor deposition fluids and chemical vapor deposition gases, or output to a chemical vapor deposition chamber, as taught and disclosed in the instant invention.

Appellants submit that Gwyn is limited to an apparatus (10) for mixing and spraying different colorants, i.e., paints, dyes and stains, to achieve various color combinations on a target workpiece, particularly, for the application of camouflage paints on military vehicles. (Col. 1, lines 13-20 and col. 2, lines 18-20.) It discloses a venturi mixing system (18) for mixing and spraying these different colorants, whereby the mixer (18) has an inlet chamber (17), a throat region (19) and an outlet chamber (21). A pressurized air source (12) supplies relatively constant pressure air to the venturi mixer system (18) whereby colorants are drawn into the venturi throat for thorough mixing and subsequent introduction to a spray nozzle. (Col. 1, lines 21-35 and col. 2, lines 20-22.) The mixed colorant flows from chamber (21) through a hose (26) to a spray gun (28). (Fig. 1 and col. 2, lines 18-49.)

Gwyn does not disclose or teach an apparatus for delivering CVD fluids to a CVD chamber having a cavity, preferably a cross-flow injector, whereby the cavity

includes inlet and exit nozzles with a throat region there-between as recited in independent claims 1, 13 and 28.

Gwyn is limited to a paint-spraying mixing device (18) for mixing different colorants and a spray gun (28) for receiving and spraying the mixed colorants (fig. 1 and col. 2, lines 18-49), it does not disclose or even suggest a CVD chamber having a cavity that includes an inlet nozzle, a throat region (adapted to atomize and mix CVD fluids therein) and an exit nozzle (adapted to introduction of the atomized, mixed CVD fluids into the CVD chamber) as is currently recited.

In view of the foregoing, Appellants submit that the claims of the instant invention include limitations not disclosed nor contemplated by Gwyn such that Gwyn does not anticipate nor render obvious the instant invention.

Additionally, with respect to the term "dopant", on page 4 of the final rejection dated June 25, 2003, the Examiner states that the present specification fails to define "dopant," and as such, has given such term the broadest reasonable interpretation. Appellants disagree with the Examiner as it is well established that "claims are given their broadest reasonable interpretation consistent with the specification." *See, In re Graves*, 69 F.3d 1147, 1152, 36 USPQ2d 1697, 1701 (Fed. Cir. 1995); *In re Etter*, 756 F.2d 852, 858, 225 USPQ 1, 5 (Fed. Cir. 1985) (en banc).

Appellants submit that if one were to interpret the pending claims with respect to the present application, the term dopant would not be interpreted to include the paints, dyes or colorants of the Gwyn patent. The present specification is directed to chemical vapor deposition processes for injection of vapor phase dopants and precursors, i.e., in the atomized and vapor phase, over a substrate or wafer surface within a chemical vapor deposition chamber for formation of a thin film thereon. (Specification, page 1, lines 9-18 and page 3, line 26 to page 4, line 13.) It does not

disclose, suggest or contemplate mixing colorants within a venturi mixer system (18) for painting a targeted workpiece, preferably a military vehicle, as is disclosed in Gwyn.

Appellants also disagree with the Examiner's position on page 4 and 5 of the above final rejection office action that "since Gwyn discloses an 'inlet nozzle,' 'throat region' and 'exit nozzle,' Gywn too discloses a 'chemical vapor deposition chamber having a cavity'", and on page 2 of the Advisory Action dated August 13, 2003, that "Gwyn discloses the elements of the chemical vapor deposition chamber as defined in applicant's claims; namely, the inlet nozzle, throat region, and exit nozzle."

Appellants have clearly recited that it is the cavity, preferably a cross-flow injector as recited in claim 28, that includes an "inlet nozzle", "throat region" and "exit nozzle" –not the CVD chamber. It is for these reasons that the applicants disagree with the above statements made by the Examiner. It is submitted that Gwyn does not disclose or contemplate chemical vapor deposition chambers, it is limited to a venturi mixer system for mixing of colorants therein and the introduction of such mixed colorants into a spray paint gun (28). (Col. 1, lines 13-35 and col. 2, lines 18-49 and Fig. 1.)

Also, Appellants disagree with the Examiner's assertion on page 4 of the June 25, 2003 final rejection, that the term "chamber" in the limitation of a chemical vapor deposition chamber having a cavity" is defined/identified as a separate element than the chamber in the preamble. It is submitted that the present claim bodies define structurally complete inventions of a CVD chamber having a cavity that includes an inlet nozzle, a throat region and an exit nozzle, such that the preamble is not limiting as the deletion thereof does not affect the claimed apparatus. *See, IMS Tech., Inc. v. Haas Automation, Inc.*, 206 F.3d 1422, 1434, 54 USPQ2d 1129, 1136-37 (Fed. Cir.

2000) (the preamble generally is not limiting when the claim body describes a structurally complete invention such that deletion of the preamble phrase does not affect the structure or steps of the claimed invention).

Again, claims 1, 3-5, 7-10, 26 and 29 include limitations not disclosed nor contemplated by Gwyn such that Gwyn does not anticipate nor render obvious these claims.

Claims 13, 15-17, 19-21, 27 and 30

As recited, claims 13, 15-17, 19-21, 27 and 30 are directed to an apparatus for delivering a plurality of chemical vapor deposition fluids to a chamber. This apparatus also includes a chemical vapor deposition chamber having a cavity that includes an inlet nozzle, a throat region and an exit nozzle.

In more detail, the inlet nozzle has a first diameter, pressure and temperature, and is adapted to receive a carrier fluid such as O_2, N_2 or He. The throat region has a second diameter and pressure, both less than the first diameter and pressure, and is connected to the inlet nozzle at a first end. The throat region also has a first and a second aperture for injecting first and second chemical vapor deposition fluids, such as precursors or dopants, into the throat region for atomization and mixing therein by the carrier fluid.

The exit nozzle is connected to the throat region at a second end. As is currently recited, the exit nozzle has the same diameter, i.e., the second diameter, as the throat region. The exit nozzle also has an exit pressure and temperature that are the same as that in the throat region such that the exit nozzle is an extension thereof. That is, the exit nozzle has the same dimensions as the throat region. The exit nozzle

is configured to introduce the mixed atomized fluids and the carrier fluid into the chemical vapor deposition chamber.

For the reasons as discussed in detail above, Appellants submit that the present invention is not anticipated by or obvious over Gwyn. Again, Gwyn is limited to a venturi mixing system (18) for mixing and spraying different colorants, whereby the mixer (18) has an inlet chamber (17), a throat region (19) and an outlet chamber (21).

To further distinguish claims 13, 15-17, 19-21, 27 and 30 from Gwyn, these claims are directed to a chemical vapor deposition chamber having a cavity that includes an inlet nozzle, a throat region and an exit nozzle, whereby the exit nozzle has the same dimensions (diameter, pressure and temperature) as the throat region. In the Gwyn patent, as shown in Figs. 1 and 2, the outlet chamber (21) is larger than the throat region (19) such that the two do not have the same diameter, and therefore, do not have the same dimensions.

Accordingly, Appellants submit that claims 13, 15-17, 19-21, 27 and 30 include limitations not disclosed nor contemplated by Gwyn such that Gwyn does not anticipate nor render obvious these claims.

Claim 28

Claim 28 to directed to an apparatus for delivering a plurality of chemical vapor deposition fluids to a chamber. This apparatus also includes a chemical vapor deposition chamber having a cavity that is a cross-flow injector that includes an inlet nozzle, a throat region and an exit nozzle.

As is further claimed, this cross-flow injector has an inlet nozzle that has a first diameter, pressure and temperature for receiving a carrier fluid including O_2, N_2, and He. The throat region of the cross-flow injector is connected to the inlet nozzle, and

has a second diameter less than the first diameter, and a second temperature and pressure. The throat region also has first and second apertures for injection of first and second CVD dopants into said throat region for atomization and mixing thereof in the throat region.

The exit nozzle of the cross-flow injector is connected to the throat region and receives the atomized first and second CVD dopants and carrier fluid for introduction into the chemical vapor deposition chamber.

Again, Gwyn does not anticipate nor render obvious claim 28 as such claim includes limitations not disclosed nor contemplated by Gwyn as discussed in detail above. Namely, Gwyn does not disclose or contemplate a CVD chamber. It is merely limited to a venturi mixing system (18) for mixing and spraying different colorants.

In addition to the above, in further distinguishing claim 28 from the Gwyn patent, claim 28 recites that the claimed cavity of the CVD chamber is a cross-flow injector. Gwyn does not disclose or suggest a cross-flow injector of a CVD chamber. Again, it is limited to a venturi mixer connected to a paint-spray gun for painting vehicles.

Appellants submit that the claims of the present application include limitations not disclosed nor contemplated by Gwyn such that Gwyn does not anticipate nor render obvious Appellants' invention

B. Claims 2, 12 and 14 have been rejected under 35 USC 103(a) as being unpatentable over Gwyn (U.S. Patent No. 4,397,422).

The Examiner has rejected claims 2, 12 and 14 under 35 USC 103(a) as being unpatentable over Gwyn (U.S. Patent No. 4,397,422).

In either a single prior art situation or a plural prior art situation combining references, the assertion of obviousness, if reasonable in light of what the prior art substantively shows and teaches, is defined as a showing of prima facie obviousness. It is the burden of the PTO to establish a prima facie case of obviousness when rejecting claims under 35 USC § 103. *In re Reuter*, 651 F.2d 751, 210 USPQ 249 (CCPA 1981). A case of prima facie obviousness is one that will be sustained unless rebuttal evidence is supplied that overcomes the prima facie case and the burden of providing such rebuttal evidence shifts to the Appellant.

It is the Appellant's position that the Examiner has not shown a prima facie case of obviousness of the Appellant's invention as Gwyn does not disclose, contemplate or suggest an apparatus comprising a chemical vapor deposition chamber having a cavity that includes an inlet nozzle, throat region and exit nozzle whereby CVD dopants are atomized and mixed in the throat region.

Further, Gwyn does not disclose, contemplate or suggest a chemical vapor deposition chamber having a cavity that includes an inlet nozzle, a throat region and an exit nozzle, whereby the exit nozzle has the same dimensions (diameter, pressure and temperature) as the throat region. Still further, Gwyn does not disclose, contemplate or suggest a CVD chamber having a cavity that is a cross-flow injector.

Gwyn is limited to simple mixing of the colorants within a throat region of a venturi mixer to achieve a final colorant mixture, which, is further mixed in an outlet chamber (21). The colorant mixture is then vaporized by pressure through a hose (26) to a spray gun (28) for painting a surface, preferably "for use in applying camouflage colorants to military vehicles." (Col. 2, lines 18-49 and col. 4, lines 58-60.) Furthermore, Gwyn does not disclose differing temperatures within the inlet chamber, throat region and outlet chamber, nor does it disclose an exit nozzle configured to

introduce atomized chemical vapor deposition fluid and carrier fluid in a CVD chamber. Still further, Gwyn does not disclose an exit nozzle having the same diameter as the throat region, as recited in the pending claims.

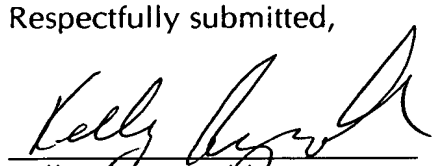
With respect to claims 2, 12 and 14, the Examiner states that it would have been obvious to one of ordinary skill in the art to alter the inlet and exit nozzle angles for optimization dependent of application criteria. In addition to the above distinctions, Appellants disagree as Gwyn does not disclose or suggest altering a nozzle angle such that the nozzle is configured to introduce atomized chemical vapor deposition dopants/precursors and a carrier fluid into a CVD chamber.

SUMMARY

It is respectfully submitted that the prior art does not disclose nor teach Appellants' invention.

Accordingly, for the reasons given above, Appellants respectfully submit that the claimed invention, as a whole, is not obvious over the cited prior art and that claims 1-5, 7-10, 12-17, 19-21 and 26-30 are clearly patentable over the references. The Final Rejection should be reversed and the claims should be allowed to issue.

Respectfully submitted,



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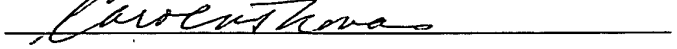
Name Carol M. Thomas Signature: 

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APPENDIX

Rejected Claims of Serial No. 09/675,860

1. (Previously Amended) An apparatus for delivering a plurality of chemical vapor deposition fluids to a chamber, comprising:

a chemical vapor deposition chamber having a cavity comprising an inlet nozzle, a throat region and an exit nozzle,

said inlet nozzle having a first diameter adapted to receive a carrier fluid, and having a first pressure and a first temperature;

said throat region, having a first and second end, connected to said inlet nozzle at said first end, said throat region having a second diameter less than said first diameter and adapted to receive said carrier fluid from said inlet nozzle, said throat region having a second pressure lower than said first pressure and a second temperature, and having a first and a second aperture adjacent to said first and second ends for injecting, respectively, a first and a second chemical vapor deposition dopant into said throat region to allow for atomization of said first and second chemical vapor deposition dopants by said carrier fluid and mixing of said atomized first and second chemical vapor deposition dopants with said carrier fluid;

said exit nozzle, connected to said throat region at said second end, having an exit pressure lower than said second pressure and a third temperature, said exit nozzle having a third diameter greater than said second diameter to allow for a substantial decrease in pressure from said first pressure to said exit pressure, and configured to introduce said mixed

atomized first and second chemical vapor deposition dopants and said carrier fluid in the chemical vapor deposition chamber.

2. (Previously Amended) The apparatus of claim 1 wherein said inlet nozzle having said first diameter is adapted to receive and funnel said carrier fluid to said throat region having said second diameter, said inlet nozzle narrowing at an angle in the range of forty to sixty degrees.

3. (Previously Amended) The apparatus of claim 1 wherein said throat region is configured to operate at a critical Mach number of 1.0.

4. (Previously Amended) The apparatus of claim 1 wherein said second pressure and said second temperature are selected to present a condition for atomization of said first and second chemical vapor deposition dopants.

5. (Previously Amended) The apparatus of claim 1 wherein said first and second chemical vapor deposition dopants comprise TEOS.

6. (Canceled.)

7. (Previously Amended) The apparatus of claim 1 wherein said throat region is configured to maintain said first pressure to be greater than said third

pressure to enhance atomization of said first and second chemical vapor deposition dopants.

8. (Previously Amended) The apparatus of claim 1 wherein said throat region is adapted such that said second pressure is lower than said first pressure allowing for said first and second chemical vapor deposition dopants to be injected into said throat region.

9. (Previously Amended) The apparatus of claim 1 wherein said inlet nozzle is adapted to receive said carrier fluid at a constant flow rate ensuring said second pressure being maintained constant through said throat region.

10. (Previously Amended) The apparatus of claim 1 wherein said first and second chemical vapor deposition dopants are introduced simultaneously into said throat region without pre-mixing.

11. (Canceled.).

12. (Previously Amended) The apparatus of claim 1 wherein said exit nozzle expands to said third diameter from said throat region second diameter at an angle in the range of twenty to forty degrees.

13. (Previously Amended) An apparatus for delivering a plurality of chemical vapor deposition fluids to a chemical vapor deposition chamber comprising:

a chemical vapor deposition chamber having a cavity comprising an inlet nozzle, a throat region and an exit nozzle,

said inlet nozzle having a first diameter adapted to receive a carrier fluid, and having a first pressure and a first temperature, said carrier fluid comprising a process compatible gas selected from the group consisting of O_2, N_2, and He;

said throat region, having a first and second end, connected to said inlet nozzle at said first end, said throat region having a second diameter less than said first diameter, and adapted to receive said carrier fluid from said inlet nozzle, said throat region having a second pressure and a second temperature and having a first and a second aperture adjacent to said first and second ends for injecting, respectively, a first and a second chemical vapor deposition fluid into said throat region to allow for atomization of said first and second chemical vapor deposition fluid by said carrier fluid and mixing of said atomized first and second chemical vapor deposition fluid with said carrier fluid, said first and second chemical vapor deposition fluids comprise fluids selected from the group consisting of precursors and dopants; and,

said exit nozzle, connected to said throat region at said second end, having said second diameter, said exit nozzle configured to maintain said

second pressure and said second temperature, such that said exit nozzle is an extension of said throat region consisting of the same dimensions as said throat region, said exit region configured to introduce said atomized first and second chemical vapor deposition fluid and said carrier fluid in said chemical vapor deposition chamber.

14. (Previously Amended) The apparatus of claim 13 wherein said inlet nozzle having said first diameter is adapted to receive and funnel said carrier fluid to said throat region having said second diameter, said inlet nozzle narrowing at an angle in the range of forty to sixty degrees.

15. (Original) The apparatus of claim 13 wherein said throat region is configured to operate at a critical Mach number of 1.0.

16. (Previously Amended) The apparatus of claim 13 wherein said second pressure and said second temperature are selected to present a condition for atomization of said first and second chemical vapor deposition fluid.

17. (Previously Amended) The apparatus of claim 13 wherein said first and second chemical vapor deposition fluids comprise TEOS.

18. (Canceled.)

19. (Previously Amended) The apparatus of claim 13 wherein said throat region, having said second diameter, is adapted such that said second pressure is lower than said first pressure allowing for said first and second chemical vapor deposition fluid to be injected into said throat region.

20. (Previously Amended) The apparatus of claim 13 wherein said inlet nozzle is adapted to receive said carrier fluid at a constant flow rate ensuring said second pressure being maintained constant through said throat region.

21. (Previously Amended) The apparatus of claim 13 wherein said first and second chemical vapor deposition fluids are introduced simultaneously into said throat region without pre-mixing.

22.-25. (Canceled.)

26. (Previously Amended) The apparatus of claim 1 wherein said throat region further comprises a third aperture for injecting a third chemical vapor deposition dopant into said throat region to allow for atomization of said third chemical vapor deposition dopant by said carrier fluid, and allow for mixing of said atomized first, second and third chemical vapor deposition dopants with said carrier fluid.

27. (Previously Amended) The apparatus of claim 13 wherein said throat region further comprises a third aperture for injecting a third chemical vapor

deposition fluid into said throat region to allow for atomization of said third chemical vapor deposition fluid by said carrier fluid, and allow for mixing of said atomized first, second and third chemical vapor deposition fluids with said carrier fluid.

28. (Previously Added) An apparatus for delivering a plurality of chemical vapor deposition fluids to a chamber, comprising:

a chemical vapor deposition chamber having a cavity comprising a cross-flow injector, said cross-flow injector comprising an inlet nozzle, a throat region and an exit nozzle;

said inlet nozzle having a first diameter adapted to receive a carrier fluid, and having a first pressure and a first temperature, said carrier fluid comprising a process compatible gas selected from the group consisting of O_2, N_2, and He;

said throat region, having a first and second end, connected to said inlet nozzle at said first end, said throat region having a second diameter less than said first diameter, and adapted to receive said carrier fluid from said inlet nozzle, said throat region having a second pressure and a second temperature and having a first and a second aperture adjacent to said first and second ends for injecting, respectively, a first and a second chemical vapor deposition dopants into said throat region to allow for atomization of said first and second chemical vapor deposition dopants by said carrier fluid and mixing of said atomized first and second chemical vapor deposition dopants with said carrier fluid; and,

said exit nozzle, having an exit pressure, connected to said throat region at said second end for receiving said atomized first and second chemical vapor deposition dopants and said carrier fluid; and

wherein said chemical vapor deposition chamber is adapted to receive said mixture of atomized first and second chemical vapor deposition dopants with said carrier fluid from said exit nozzle of said cavity.

29. (Previously Added) The apparatus of claim 28 wherein said exit nozzle has an exit pressure lower than said second pressure and a third temperature, said exit nozzle having a third diameter greater than said second diameter to allow for a substantial decrease in pressure from said first pressure to said exit pressure, and configured to introduce said atomized first and second chemical vapor deposition dopants and said carrier fluid in the chemical vapor deposition chamber.

30. (Previously Added) The apparatus of claim 28 wherein said exit nozzle has said second pressure and said second temperature, such that said exit nozzle is an extension of said throat region consisting of the same dimensions as said throat region, said exit region being configured to introduce said atomized first and second chemical vapor deposition dopants and said carrier fluid in said chemical vapor deposition chamber.